DOCUMENT RESUME

ED 434 038 SE 062 893

AUTHOR Allen, Bradford D.; Carifio, James
TITLE The Development and Validation of a Math Affect Trait Questionnaire for the Investigation of Affect during Mathematical Problem Solving.
PUB DATE 1999-11-00
NOTE 26p.
PUB TYPE Reports - Research (143)
EDRS PRICE MF01/PC02 Plus Postage.
DESCRIPTORS Elementary Secondary Education; *Mathematics Education; Measures (Individuals); *Problem Solving; Questionnaires; *Self Esteem

ABSTRACT

The development and validation of the Math Affect Trait Questionnaire (MATQ) for the investigation of affect during mathematical problem solving is presented. Anxiety, math interest, and self-esteem under problem solving conditions are the main constructs measured by the MATQ. The instrument validation process revealed that problem correctness interacted with the relationship between math interest and self-esteem, and also interacted with the relationship between math interest and locus of control. Results highlight what may be the beginning of a vicious cycle where interested but struggling students loose self-esteem, attribute their difficulties to circumstances beyond their control, and eventually loose interest in math. The Math Affect Trait Questionnaire is a viable instrument which may be used to investigate areas involving math affect traits and their influences on problem solving. (Contains 11 references.) (Author/ASK)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

SCOPE OF INTEREST NOTICE
The ERIC Facility has assigned this document for processing to: SE
In our judgment, this document is also of interest to the Clearinghouses noted to the right. Indexing should reflect their special points of view. TM

ED 434 038

The Development and Validation of a Math Affect Trait Questionnaire for the Investigation of Affect During Mathematical Problem Solving

Bradford D. Allen, Florida Institute of Technology
James Carifio, UMASS at Lowell

ABSTRACT

The development and validation of the Math Affect Trait Questionnaire (MATQ) for the investigation of affect during mathematical problem solving is presented. Anxiety, math interest, and self-esteem under problem solving conditions are the main constructs measured by the MATQ. The instrument validation process revealed that problem correctness interacted with the relationship between math interest and self-esteem, and also interacted with the relationship between math interest and locus of control. Results highlight what may be the beginning of a vicious cycle where interested but struggling students loose self-esteem, attribute their difficulties to circumstances beyond their control, and eventually loose interest in math. The Math Affect Trait Questionnaire is a viable instrument which may be used to investigate areas involving math affect traits and their influences on problem solving.

November 1999

PERMISSION TO REPRODUCE AND DISSEMINATE THIS MATERIAL HAS BEEN GRANTED BY
B. Allen
TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

U.S. DEPARTMENT OF EDUCATION
Office of Educational Research and Improvement
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)
☐ This document has been reproduced as received from the person or organization originating it.
☐ Minor changes have been made to improve reproduction quality.
• Points of view or opinions stated in this document do not necessarily represent official OERI position or policy.

BEST COPY AVAILABLE

SE029693

Researchers and classroom teachers have long recognized that affect traits influence success in mathematical problem solving. As (Mandler, 1972) and others have pointed out, affect traits are good predictors of success in school.

Individuals who struggle with mathematical problem solving generally have poor self-images, resistive attitudes, negative dispositions, and false beliefs about doing mathematics. Therefore, the widely agreed upon ideas that students need to be more reflective about learning, more aware of problem solving strategies, and more skilled in handling strategies (Brandt 1990) need to be extended to strategies related to the management and improvement of math affect traits. Math traits not only influence the problem solving process but also students' outlooks toward mathematics.

To better understand affect traits and their influences on problem solving, instruments which measure traits need to be developed. The benefit for both learning and assessment could be great. A valid math affect instrument would, according to Mandler (1989), allow two different macroanalytic approaches to be employed in studying the complex thinking of problem solving. One approach would look at affect versus task performance across a group of individuals. The other approach would look at affect across a group of tasks. The former would allow individuals to be ranked so that their difficulties can be ameliorated. The latter would rank tasks so that designs which eliminate difficulties due

to affect may be found. Mandler states that the best of experimental designs would include both types of approaches and allow both people and tasks to be ranked.

The Math Affect Trait Questionnaire (MATQ) is a 25 item instrument designed to measure various affect traits during mathematical problem solving. The development and validation of the MATQ is presented below.

INSTRUMENT DEVELOPMENT

Anderson (1981), and Gable and Wolf (1993) identify five traits which are correlated with emotion and influence learning and testing. These five traits are academic motivation, academic self-esteem, anxiety, interests in school, and locus of control. The Mathematics Affect Trait Questionnaire (see Appendix) was designed to measure individual differences on the five traits in order to study the effects of affect traits on problem solving. Measurements of these traits reflect subjects' dispositions to respond emotionally during problem solving.

Anderson (1981) describes nine instruments designed to measure his five affect traits. These instruments may be administered together as a battery to get an affect trait profile. However, because the time to complete nine instruments would be prohibitive, the MATQ was developed by selecting 5 items per trait at random from the instruments (see below). Carifio (1995) shows empirically that random samples of items from validated

instruments have the same psychometric properties (given adjustments for sampling error) as the full length instruments. Anderson's battery of instruments was selected because they were developed specifically for adolescents and young adults and because they possessed the following five characteristics of instrument excellence: (1)communication value - the instrument could be understood by the person responding to it, (2)objectivity - instrument scores are independent of the scorer, (3)validity - the instrument provides information about the trait it was designed to measure, (4)reliability - the instrument is consistent in a variety of situations, and (5)interpretability - the instrument provides information that can be understood by interested parties.

The five affect traits and Anderson's instruments which measure those traits are discussed below. The items selected from Anderson's battery of instruments which are used in the Math Affect Trait Questionnaire are also given below:

ACADEMIC MOTIVATION- The *School Attitude Measure* from the Scott Foresman Test Division is an affective instrument that consists of five subscales. Items for the MATQ came from the subscale entitled "Motivation for Schooling." This subscale assesses the extent to which students value schooling and education. Internal consistencies for this scale ranged from .84 to .91 over several samples. MATQ academic motivation items were also selected from the *Need for Academic Competence Scale* developed at New York

University School of Education. This scale measures the extent students value academic success. Internal consistencies ranged from .80 to .83. The MATQ items selected at random from these two instruments were the following:

#3 Often I feel I don't want to go to school because I have things to do that are more important.

#4 Forgetting about my grades, I feel my performance in school is actually quite good.

#8 I think it is important to get as much education as possible.

#10 If the teacher says I am doing well in school, it is because the teacher is having a good day

#23 People need a good education if they want to get the "good things" in life.

ACADEMIC SELF-ESTEEM - The *Self-Concept of Academic Ability Scale* was developed at Michigan State University. Internal consistencies for this scale ranged from .65 to .95 over several samples. The *Academic Self-Image Scale* by J. Baker-Lunn (Cohen 1976) has an internal consistency of .88. These scales measure students' perceptions of their ability to do the majority of school tasks in a competent fashion, students' expectations of success in assignments and tests, and the degree to which students feel that with the necessary effort, they would perform adequately in school. The MATQ items selected at random from these two instruments were the following:

#14 I am not as smart as others in my class.

#15 No matter what I do, I can not make my school experience any better.

#18 It is important to me to be one of the best students in my class.

#19 I do good work in school.

#24 Compared to others in my class, my ability to succeed in school is above average.

MATHEMATICS ANXIETY - The *Mathematics Anxiety Rating Scale* (Richardson and Suinn 1972) is a 98 item scale developed to measure mathematics anxiety for the purpose of identifying mathematically anxious students. The stability coefficient is .85 and the internal consistency is .97. The *State-Trait Anxiety Inventory* (Spielberger, Gorsuch, and Lushene 1970) consists of two subscales: a state anxiety scale which measures anxiety from a specific situation, and a trait anxiety scale which measures anxiety experienced in situations in general. Internal consistency estimates range from .89 to .92. The correlation between the rating scale and the trait scale is about .50 (Plake and Parker 1982). MATQ items were selected from the trait anxiety scale. These MATQ math anxiety items were the following:

#1 I worry about how well I did on tests after I have taken them.
#6 I often feel like I want to get away from it all.
#11 Even when I try to concentrate, I am easily distracted.
#16 Sometimes I lack self-confidence.
#21 I often feel nervous before a test.

INTERESTS IN MATHEMATICS- The *IEA Interest Inventories* was developed at the University of Kentucky College of Education under the auspices of the International Association for the Evaluation of Educational Achievement. The inventories were developed in the areas of mathematics, science, literature, reading, and French. This scale has an internal consistency of .83. MATQ math interest items were selected from the mathematics inventory. These MATQ items were the following:

#2 In math class, I am often curious about how a problem is solved.

#7 Math homework is my favorite homework.

#12 I find math to be a real bore.

#17 I would not enjoy solving word problems even if I were good at it.

#22 Math is not very interesting.

LOCUS OF CONTROL - The *School Attitude Measure* from the Scott Foresman Test Division contains several subscales. The subscale "Student's Sense of Control Over School Performance" measures the degree to which students feel their performance is due to ability or luck, the degree to which students take responsibility for what happens in school, and the degree to which students are aware of the relationship between their actions and the outcomes of schooling. This subscale has an internal consistency estimate between .80 to .89 and a stability coefficient between .84 to .91 over a four week period. The *Intellectual Achievement Responsibility Questionnaire* (Crandall, Katkovsky, and Crandall 1965) has a stability coefficient of .66 for positive event items and .74 for negative event items. The MATQ locus of control items selected at random from these instruments were the following:

#5 If I do not do well on a test, it is because the test was too hard.

#9 A lot of the work in school is difficult.

#13 I feel lousy when I can't understand what the teacher is explaining.

#20 Before a test, I hope that I will have good luck.

#25 I believe good things happen in school as a result of working very hard.

All 25 items on the MATQ are modified Likert questions with 6-point scales ranging from "agree strongly" to "disagree

strongly." The MATQ was specifically designed with no neutral point to force subjects to decide whether they agreed or disagreed with the statements. Items number 3, 5, 9, 10, 12, 13, 14, 15, 17, 20, and 22 were reverse scored on the MATQ.

MATQ responses were scored from 1 to 6 with 1 corresponding to "strongly disagree" and 6 corresponding to "strongly agree." Responses to the five questions for each trait were summed to get a total score for each trait. According to Anderson, trait scores may be combined to form composite scores. For example, academic motivation, self-esteem, and locus of control may be combined to form a composite self-efficacy variable. Math interest and anxiety may be combined to form a general attitude toward math variable.

High trait scores imply the presence of anxiety, an interest in math, value placed on education, favorable self-esteem, and an internal locus of control. Low trait scores imply low anxiety, boredom with math and with school, believing that school is difficult and that others are smarter, and that high achievement is beyond their control.

INSTRUMENT VALIDATION

Two-hundred-nine undergraduate students took part in an experiment which comprised of having each student answer the Math Affect Trait Questionnaire just prior to solving or trying to solve two math problems. The subjects were aware that one math

problem was a low difficulty problem and the other was a medium difficulty problem. In all, 206 complete Math Affect Trait Questionnaires were collected.

To investigate and improve the validity and reliability of the Math Affect Trait Questionnaire, item means and standard deviations were examined. Items were then factor analyzed and reliability analyses were performed.

Table 1 contains summary statistics on the Math Affect Trait Questionnaire. When the items were checked for aberrant means and/or low standard deviations, items 1, 8,19, and 25 were found to have low standard deviations and/or high or low means. These items were eliminated from further analyses. The MATQ item distributions were often skewed which influenced correlations, which in turn influenced factor analysis results. The skewed distributions appeared to be due to subjects uniformly agreeing or disagreeing with the item statements.

Table 1. Summary Statistics for Math Affect Trait Questionnaire Items (N=206).

Item#	Mean	Std Dev	Kurtosis	Skewness	Label/ Construct
1	4.83	1.20	2.03	-1.43	worry/anxiety
2	4.72	1.34	.98	-1.17	curious/interests
3	4.25	1.49	-.87	-.46	other-things/values

Table 1. Summary Statistics for Math Affect Trait Questionnaire Items (N=206).

Item#	Mean	Std Dev	Kurtosis	Skewness	Label/ Construct
4	4.31	1.38	-.37	-.66	performance/self-esteem
5	3.97	1.17	-.32	-.06	too-hard/locus-of-control
6	4.60	1.37	.05	-.86	get-away/anxiety
7	3.26	1.87	-1.43	.11	math-homework/interests
8	5.57	.75	4.98	-2.08	education/values
9	2.94	1.33	-.09	.60	school-work/self-esteem
10	4.79	1.26	-.07	-.84	teacher/locus-of-control
11	3.08	1.48	-.82	.38	distracted/anxiety
12	3.68	1.69	-1.11	-.20	math-boring/interests
13	2.28	1.29	.83	1.07	comprehension/values
14	4.22	1.53	-1.03	-.40	others/self-esteem
15	4.77	1.20	.99	-1.08	what I do/locus-of-control
16	4.05	1.49	-.55	-.57	self-confidence/anxiety
17	3.67	1.73	-1.17	-.19	word-problems/interests
18	4.29	1.38	-.48	-.51	best-student/values
19	4.81	.97	.72	-.75	my-work/self-esteem
20	2.60	1.43	-.19	.70	luck/locus-of-control
21	4.61	1.35	.23	-.93	nervous/anxiety
22	3.58	1.71	-1.18	-.19	math-interests/interest
23	2.09	1.37	.53	1.20	need education/values
24	4.40	1.19	-.06	-.50	compared-to/self-esteem
25	5.40	.89	1.87	-1.52	working/locus-of-control

Table 2 presents means and standard deviations for the Math Affect Trait Questionnaire's hypothesized scales.

Table 2. Math Affect Trait Questionnaire hypothetical scale mean, standard deviation, kurtosis, skewness and range (N=206).

	theoretical mean	mean	std dev	kurtosis	skewness	range
anxiety 4 items	14	17.18	3.57	-.01	-.42	5-24
math interests 5 items	17.5	18.92	6.22	-.72	-.22	5-30
education values 4 items	14	15.73	3.10	.10	-.12	5-24
self esteem 4 items	14	15.87	3.27	-.28	.07	7-24
locus of control 4 items	14	16.08	2.92	.71	-.25	5-23

As can be seen from the scale means, on average, subjects were anxious and slightly interested in math and education with slightly positive self-esteem. They also tended to have an internal locus of control. Differences from neutral on math interests, educational values and self-esteem scales were so small they are likely due to random error. The scales were not normed so the midpoint of the range must be used to assess relative position.

If the MATQ scales were indeed valid in measuring the trait constructs, an indication of the homogeneity of the subjects can

be seen in the low variation of scale scores. Subjects were somewhat heterogeneous in their interest in math but were very homogeneous with respect to valuing education, self-esteem and locus of control. If the MATQ does measure Gable and Wolf's, and Anderson's math affect traits, then the subject pool was fairly homogeneous in these respects. On the other hand, the items themselves may have been responsible for low variation over the five scales. A poor choice of items on a trait scale could easily result in a low variance on that scale. In either case, the resulting low correlations account for reduced correlations and poor factor analysis results.

To better evaluate the hypothesized scales, correlations between items and total scale scores were checked to be sure most items on each scale predicted the scale scores. Correlations between all scales were examined. Scale scores were factor analyzed separately and together. The distributions of scale scores were also checked.

Table 3 presents correlations between the Math Affect Trait Questionnaire scales. In general, the scales were moderately correlated.

Table 4 presents the correlations between the Math Affect Trait Questionnaire scale totals for those with a math problem correctness level of 7 or greater (i.e. the top quartile in math achievement on two math problems N=61) and 4 or less (i.e. the

Table 3. Correlations between the Math Affect Trait Questionnaire scale totals (N=206).

	anxiety	math interests	education values	self-esteem	locus of control
anxiety	__	-.13	-.29*	-.43*	-.26*
math interests		__	.26*	.09	.02
education values			__	.27*	.23*
self-esteem				__	.28*
locus of control					__

critical values for $r \neq 0$: r=.14 at p=.05, r=.18 at p=.01

bottom quartile in math achievement on two math problems N=51). The math problem correctness level range was from 0 to 12.

By examining correlations in terms of problem correctness achievement, it can be seen that the relationships between math interest and self-esteem, and also the relationships between math interest and locus of control change significantly. For high achievers, the self-esteem and locus of control correlations with math interest are positive (i.e. increased math interest means increased self-esteem and locus of control). For low achievers, the self-esteem and locus of control correlations with math interest are negative (i.e. increased math interest means decreased self-esteem and locus of control). Significant differences between high and low achievement correlations occur only for math interest. That is, for students who do well, as math

interest increases their self-esteem also increases as would be expected; for students who do poorly, as math interest increases their self-esteem decreases. This result highlights what may be the beginning of a vicious cycle where interested but struggling students loose self-esteem, attribute their difficulties to circumstances beyond their control, and eventually loose interest in math.

Table 4. Correlations between the MATQ scale totals for high (N=61) and low (N=51) math problem correctness levels.

achievement	math anxiety	math interests	education values	self-esteem	locus of control
anxiety	high	—	-.24	-.18	-.38	-.21
	low	—	.02	-.24	-.28	-.23
math interests	high		—	.31	.30*	.20**
	low		—	.15	-.14*	-.27**
education values	high			—	.32	.30
	low			—	.05	.17
self esteem	high				—	.20
	low				—	.30

* Fisher z=2.31, p=.02
** Fisher z=2.46, p=.01

Correlations between individual scale items and total scale scores were high. Correlations between individual anxiety items and the anxiety scale score ranged from .56 to .68 with a mean of .60. Correlations between individual math interest items

and the math interest scale score ranged from .55 to .88 with a mean of .74. Correlations between individual education-values items and the education-values scale score ranged from .41 to .64 with a mean of .56. Correlations between individual self-esteem items and the self-esteem scale score ranged from .13 to .72 with a mean of .54. Correlations between individual locus of control items and the locus of control scale score ranged from .52 to .64 with a mean of .58.

Except for item 9, the Math Affect Trait Questionnaire items predicted their scale total scores reasonably well. The best scale score predictors were items in the math interest and anxiety scales. This result parallels factor analysis results which gave these items the highest loadings and the best groupings along a given factor; math interest items dominated factor I and anxiety items were prominent on factor II.

Table 5 presents the factor analysis results of the Math Affect Trait Questionnaire hypothesized scales. Principle components factoring with varimax orthogonal rotation was used. Scale scores were Kaiser normalized and 1's were used on the matrix diagonal. The eigenvalue cutoff was set at one. Loadings less than .4 are not shown. The cumulative percent variance accounted for by the two retained factors was 60% with 39% and 21% attributed to factors I and II respectively.

Table 5. Principle components factor analysis with varimax orthogonal rotation of Math Affect Trait Questionnaire scales (N=206).

scale	factor I	factor II	communality
anxiety	-.73		.56
math interest		.83	.82
education values	.66		.55
self-esteem	.72		.59
locus of control	.57		.49
percent variance	39%	21%	60%

When math interest is dropped and the remaining four scales were factored, one factor arose which accounted for 47% of the variance. This factor can be viewed as a contrast between anxiety with values, self-esteem and locus of control. Table 6 presents the factor analysis results.

Table 6. Principle components factor analysis of anxiety, education values, self-esteem and locus of control (N=206).

scale	factor I	communality
anxiety	-.75	.56
education values	.75	.39
self-esteem	.62	.56
locus of control	.62	.38
percent variance	47%	47%

Table 7 presents a factoring of Math Affect Trait Questionnaire items in terms of the hypothesized scales. Alpha

internal consistency and average h^2 communality estimates of reliability are also presented. Principle components factoring with varimax orthogonal rotation was used. Items were Kaiser normalized and 1's were used on the matrix diagonal. The eigenvalue cutoff was set at 1.6 in order to combine all factors that contributed less than five percent to the total variance into three main factors. Retaining more than three factors in this analysis resulted in one or more scales with only three items per factor. Only cases with no missing values on all items were analyzed. Loadings less than .3 are not shown. The cumulative percent variance accounted for by the three retained factors is 38% with 16%, 13% and 9% attributed to factors I, II and II respectively.

Table 7. Hypothesized scales in the Math Affect Trait Questionnaire with Internal Consistency Estimates, Unsorted Orthogonally Rotated Factor Loadings and Item Communalities (N=206).

scale / items	factor I	factor II	factor III	h^2
ANXIETY				
6. I often feel like I want to get away from it all.	-.38		-.31	.26
11. Even when I try to concentrate, I am easily distracted.		-.57	-.34	.44
16. Sometimes I lack self-confidence.		-.32	-.51	.36
21. I often feel nervous before a test.			-.65	.44
α=.54				h^2=.38
INTERESTS				
2. In math class, I am often curious about how a problem is solved.	.52			.35
7. Math homework is my favorite homework.	.83			.70
12. I find math to be a real bore.	.90			.83
17. I would not enjoy solving word problems even if I were good at it.	.44			.25
22. Math is not very interesting.	.89			.80
α=.80				h^2=.59
VALUES				

Table 7. Hypothesized scales in the Math Affect Trait Questionnaire with Internal Consistency Estimates, Unsorted Orthogonally Rotated Factor Loadings and Item Communalities (N=206).

scale / items	factor I	factor II	factor III	h^2
3. Often I feel I don't want to go to school because I have things to do that are more important.		.41		.23
4. Forgetting about my grades, I feel my performance in school is actually quite good.				.02
10. If the teacher says I am doing well in school, it is because the teacher is having a good day				.10
23. People need a good education if they want to get the good things in life.		.45	-.38	.35
α=.27				h^2=.18
SELF-ESTEEM				
14. Compared with others in my class, I am not as smart.		.63	42	.58
15. No matter what I do, I can not make my school experience any better.		.52		.27
18. It is important to me to be the best student in my class.		.57		.46
24. Compared to others in my class, my ability to succeed in school is above average.		.65		.42
α=.52				h^2=.43

Table 7. Hypothesized scales in the Math Affect Trait Questionnaire with Internal Consistency Estimates, Unsorted Orthogonally Rotated Factor Loadings and Item Communalities (N=206).

scale / items	factor I	factor II	factor III	h^2
LOCUS OF CONTROL				
5. If I do not do well on a test, it is because the test was too hard.			.35	.14
9. A lot of the work in school is difficult.			.52	.28
13. I feel lousy when I can't understand what the teacher is telling me.			.59	.37
20. Before a test, I hope that I will have good luck.			.49	.25
α=.29				h^2=.19
Percent Variance	17	13	8	.26

All of the Math Affect Trait Questionnaire's hypothesized scales except for math values were validated by the above factor analysis. Anxiety and locus of control both loaded on the third factor but in a contrasting manner. High anxiety implied low locus of control and low anxiety implied high locus of control. This result refutes Anderson's, and Gable and Wolf's claims in the context of problem solving that anxiety and locus of control are two separate and distinct traits.

CONCLUSIONS

The development and validation of the Math Affect Trait Questionnaire (MATQ) for the investigation of affect during mathematical problem solving is presented. Five hypothesized scales were designed into the MATQ to measure the five traits identified by Anderson, and Gable and Wolf which are correlated with emotion and which influence learning and testing. However, in the context of mathematical problem solving, the five affect traits identified by Anderson, and Gable and Wolf were not corroborated by factor analyses of MATQ responses. Moreover, in the context of problem solving, the results refute Anderson's, and Gable and Wolf's claims that anxiety and locus of control are separate and distinct traits.

Based on the correlations and variances of scales, factor analysis results, and stepwise regression analysis, it was found that under problem solving conditions, anxiety, math interest, and self-esteem are the main constructs measured by the Math Affect Trait Questionnaire.

The MATQ's items may have been responsible for low variations on the five trait scales. A poor choice of one or more items on the trait scales may have led to low variances on the scales. The scales would have been more useful with items which allowed a wider range of responses. Further, low item

correlations resulted in reduced scale correlations and poor factor analysis results.

An examination of correlations in terms of problem correctness score revealed that the relationships between math interest and self-esteem, and between math interest and locus of control change significantly as correctness score changed. For high achievers, self-esteem and locus of control correlated with math interest in a positive manner. That is, increased math interest is associated with increased self-esteem and internal locus of control. For low achievers, correlations of self-esteem and locus of control with math interest were negative. That is, increased math interest is associated with decreased self-esteem and external locus of control. Significant differences between high and low achievement correlations occurred only for math interest. For people that did poorly, as math interest increased their self-esteem decreased. For people that did well, as math interest increased their self-esteem also increased. Further research is needed in this area to discern whether instructional methods, instructional content, or the assessment process itself may be detrimental to learning for students who are interested in math but are struggling to learn math. The Math Affect Trait Questionnaire may be a viable instrument to investigate this and other areas involving math affect traits and their influences on problem solving.

MATH AFFECT TRAIT QUESTIONNAIRE

MATQ Questionnaire

1. I worry about how well I did on tests after I have taken them.	agree strongly..... agree moderately..... agree slightly..... disagree slightly..... disagree moderately..... disagree strongly.....	2. In math class, I am often curious about how a problem is solved.	agree strongly..... agree moderately..... agree slightly..... disagree slightly..... disagree moderately..... disagree strongly.....
3. Often I feel I don't want to go to school because I have things to do that are more important.	agree strongly..... agree moderately..... agree slightly..... disagree slightly..... disagree moderately..... disagree strongly.....	4. Forgetting about my grades, I feel my performance in school is actually quite good.	agree strongly..... agree moderately..... agree slightly..... disagree slightly..... disagree moderately..... disagree strongly.....
5. If I do not do well on a test, it is because the test was too hard.	agree strongly..... agree moderately..... agree slightly..... disagree slightly..... disagree moderately..... disagree strongly.....	6. I often feel like I want to get away from it all.	agree strongly..... agree moderately..... agree slightly..... disagree slightly..... disagree moderately..... disagree strongly.....
7. Math homework is my favorite homework.	agree strongly..... agree moderately..... agree slightly..... disagree slightly..... disagree moderately..... disagree strongly.....	8. I think it is important to get as much education as possible.	agree strongly..... agree moderately..... agree slightly..... disagree slightly..... disagree moderately..... disagree strongly.....
9. A lot of the work in school is difficult.	agree strongly..... agree moderately..... agree slightly..... disagree slightly..... disagree moderately..... disagree strongly.....	10. If the teacher says I am doing well in school, it is because the teacher is having a good day	agree strongly..... agree moderately..... agree slightly..... disagree slightly..... disagree moderately..... disagree strongly.....
11. Even when I try to concentrate, I am easily distracted.	agree strongly..... agree moderately..... agree slightly..... disagree slightly..... disagree moderately..... disagree strongly.....	12. I find math to be a real bore.	agree strongly..... agree moderately..... agree slightly..... disagree slightly..... disagree moderately..... disagree strongly.....

BEST COPY AVAILABLE

MATQ Questionnaire

13. I feel lousy when I can't understand what the teacher is explaining.	agree strongly..... agree moderately..... agree slightly..... disagree slightly..... disagree moderately..... disagree strongly.....	14. I am not as smart as others in my class.	agree strongly..... agree moderately..... agree slightly..... disagree slightly..... disagree moderately..... disagree strongly.....
15. No matter what I do, I can not make my school experience any better.	agree strongly..... agree moderately..... agree slightly..... disagree slightly..... disagree moderately..... disagree strongly.....	16. Sometimes I lack self-confidence.	agree strongly..... agree moderately..... agree slightly..... disagree slightly..... disagree moderately..... disagree strongly.....
17. I would not enjoy solving word problems even if I were good at it.	agree strongly..... agree moderately..... agree slightly..... disagree slightly..... disagree moderately..... disagree strongly.....	18. It is important to me to be one of the best students in my class.	agree strongly..... agree moderately..... agree slightly..... disagree slightly..... disagree moderately..... disagree strongly.....
19. I do good work in school.	agree strongly..... agree moderately..... agree slightly..... disagree slightly..... disagree moderately..... disagree strongly.....	20. Before a test, I hope that I will have good luck.	agree strongly..... agree moderately..... agree slightly..... disagree slightly..... disagree moderately..... disagree strongly.....
21. I often feel nervous before a test.	agree strongly..... agree moderately..... agree slightly..... disagree slightly..... disagree moderately..... disagree strongly.....	22. Math is not very interesting.	agree strongly..... agree moderately..... agree slightly..... disagree slightly..... disagree moderately..... disagree strongly.....
23. People need a good education if they want to get the "good things" in life.	agree strongly..... agree moderately..... agree slightly..... disagree slightly..... disagree moderately..... disagree strongly.....	24. Compared to others in my class, my ability to succeed in school is above average.	agree strongly..... agree moderately..... agree slightly..... disagree slightly..... disagree moderately..... disagree strongly.....
25. I believe good things happen in school as a result of working very hard.	agree strongly..... agree moderately..... agree slightly..... disagree slightly..... disagree moderately..... disagree strongly.....	26.	

BEST COPY AVAILABLE

REFERENCES

Anderson, L. W. (1981). Assessing affective characteristics in the schools. Boston: Allyn and Bacon.

Brandt, R. (1990). On knowledge and cognitive skills: A conversation with David Perkins. Educational Leadership, 47, 81-89.

Carifio, J. (1995). Sensitive data and students' tendencies to give socially desirable responses. University of Massachusetts Lowell.

Cohen, L. (1976). The academic self-image scale. Educational Research in Classrooms and Schools. London: Harper and Row.

Crandall, V. C., Katkovsky, W. & Crandall, V. J. (1965). Children's belief in their own control of reinforcements in intellectual academic achievement situations. Child Development, 36, 91-109.

Gable, R. K. & Wolf, M. B. (1993). Instrument development in the affective domain (2nd Ed.). Boston: Kluwen Academic Publishers.

Mandler, G. (1972). Helplessness: Theory and research in anxiety. In C. D. Spielberger (Ed.), Anxiety: Current trends in theory and research (Vol. 2). New York: Academic Press.

Mandler, G. (1989). Affect and learning: Causes and consequences of emotional interaction. In D. B. McLeod & V. M. Adams (Eds), Affect and mathematical problem solving: A new perspective. NY: Springer-Verlag.

Plake B. S. & Parker S. P. (1982). The development and validation of a revised version of the mathematics anxiety rating scale. Educational and Psychological Measurement, 42, 551-557.

Richardson, F. C. & Suinn, R. M. (1972). The mathematics anxiety rating scale: Psychometric data. Journal of Counseling Psychology, 19, 551-554.

Spielberger, C. D., Gorsuch, R. L., & Lushene, R. E. (1970). Manual for the state-trait anxiety inventory. Palo Alto, CA: Consulting Psychologist Press.